Chapter Three

AIRPORT FACILITY REQUIREMENTS

Airport Facility Requirements

To properly plan for the future of Corvallis Municipal Airport, it is necessary to translate forecast aviation demand into the specific types and quantities of facilities that can adequately serve this identified demand. This chapter uses the results of the forecasts presented in Chapter Two, as well as established planning criteria, to determine the airfield (i.e., runways, taxiways, navigational aids, marking and lighting) and landside (i.e., hangars, aircraft parking apron, and automobile parking) facility requirements.

The objective of this effort is to identify, in general terms, the adequacy of the existing airport facilities and outline what new facilities may be needed, and when these may be needed, to accommodate forecast demands. Having established these facility requirements, alternatives for providing these facilities will be evaluated in Chapter Four - Alternatives to determine the most cost-effective and efficient means for implementation.

PLANNING HORIZONS

An updated set of aviation demand forecasts for Corvallis Municipal Airport has been established. These activity forecasts include annual operations, based aircraft, fleet mix, and peaking characteristics. With this information, specific components of the airfield and landside system can be evaluated to determine their capacity to accommodate future demand.

Cost-effective, efficient, and orderly development of an airport should rely more upon actual demand at an airport than on a time-based forecast figure. In order to develop a master plan that is **demand-based** rather than time-based, a series of planning horizon milestones have been established that take into consideration

the reasonable range of aviation demand projections. The planning horizons are the Short Term (approximately years 1-5), the Intermediate Term (years 6-10), and the Long Term (years 11-20).

It is important to consider that the actual activity at the airport may be higher or lower than what the annualized forecast portrays. By planning according to activity milestones, the resultant plan can accommodate unexpected shifts or changes in the area's aviation demand. It is important for the plan to accommodate these changes so that airport officials can respond to unexpected changes in a timely fashion.

The most important reason for utilizing milestones is it allows airport management to make decisions and develop facilities according to need generated by actual demand levels. The demand-based schedule provides flexibility in development, as development schedules can be slowed or expedited according to demand at any given time over the planning period. The resultant plan provides airport officials with a financially responsible and needs-based program.

CRITICAL AIRCRAFT

The selection of appropriate Federal Aviation Administration (FAA) design standards for the development and location of airport facilities is based primarily upon the characteristics of the aircraft which are currently using or are expected to use the airport. The critical design aircraft is used to define the design parameters for the airport. The critical design aircraft is defined as the most demanding category of aircraft, or family of aircraft, which conducts at least 500 operations per year at the airport. Planning for future aircraft use is of particular importance since the design standards are used to plan separation distances between facilities. These future standards must be considered now to ensure that short term development does not preclude the long range potential needs of the airport.

The FAA has established a coding system to relate airport design criteria to the operational and physical characteristics of aircraft expected to use the airport. This airport reference code (ARC) has two components. The first component, depicted by a letter, is the aircraft approach category and relates to aircraft approach speed (operational characteristic). The second component, depicted by a Roman numeral, is the airplane design group (ADG) and relates to aircraft wingspan or tail height (physical characteristic). Generally, aircraft approach speed applies to runways and runway-related facilities, while airplane wingspan primarily relates to separation criteria involving taxiways, taxilanes, and landside facilities.

According to FAA Advisory Circular (AC) 150/5300-13, *Airport Design*, an aircraft's approach category is based upon 1.3 times its stall speed in landing configuration at that aircraft's maximum certificated weight. The ADG is based upon either the aircraft's wingspan or tail height, which-ever is greater. For example, an aircraft may fall in ADG II for wingspan, but ADG III for tail height. This aircraft would be classified under ADG-III. **Table 3A** presents the components of the airport reference code.

Exhibit 3A summarizes representative aircraft by ARC. As shown on the exhibit, the airport does not currently, nor is it expected to, regularly serve aircraft in ARCs C-IV, D-IV, or D-V. Large transport aircraft are used by commercial carriers which do not currently use, nor are they expected to use, the airport through the

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A-I

- Beech Baron 55
- **Beech Bonanza**
- Cessna 150
- Cessna 172
- Cessna Citation Mustang
- Eclipse 500
- Piper Archer
- Piper Seneca

B-I less than 12,500 lbs.

- Beech Baron 58
- Beech King Air 100
- Cessna 402
- **Cessna 421**
- Piper Navajo
- Piper Cheyenne
- Swearingen Metroliner
- Cessna Citation I

B-II less than 12,500 lbs.

- **Super King Air 200**
- Cessna 441
- DHC Twin Otter

B-I, B-II over 12,500 lbs.

- Super King Air 350
- Beech 1900
- Jetstream 31
- Falcon 10, 20, 50
- Falcon 200, 900
- **Citation II**, III, IV, V
- Saab 340
- Embraer 120

A-III, B-III

- DHC Dash 7
- **DHC Dash 8**
- DC-3
- Convair 580
- Fairchild F-27
- ATR 72
- ATP

C-I, D-I

- Beech 400
- **Lear 25, 31, 35, 45, 55, 60**
- Israeli Westwind
- HS 125-400, 700

C-II, D-II

- Cessna Citation III, VI, VIII, X
- **Gulfstream II, III, IV**
- Canadair 600
- ERJ-135, 140, 145
- CRJ-200/700
- Embraer Regional Jet
- Lockheed JetStar

C-III, D-III

- ERJ-170, 190
- CRJ 700, 900
- Boeing Business Jet
- **B 737-300 Series**
- MD-80, DC-9
- Fokker 70, 100
- A319, A320
- Gulfstream V
- Global Express

C-IV, D-IV

- **B-757**
- B-767
- C-130
- DC-8-70
- MD-11

D-V

- **B-747** Series
- B-777

Note: Aircraft pictured is identified in bold type.

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Exhibit 3A
AIRPORT REFERENCE CODES

planning period. Some of the largest business jets, such as the Gulfstream V, fall in ARC D-III, and are capable of operating at the airport under certain conditions.

TABLE 3A
Airport Reference Code

Aircraft Approach Category		
Category	*Speed*	
A	< 91 Knots	
B	91- < 121 Knots	
C	121- < 141 Knots	
D	141- <166 Knots	
E	> 166 Knots	
Airplane Design Group[1]		
Group	*Tail Height (ft)*	*Wingspan (ft)*
I	< 20	< 49
II	20- < 30	49- < 79
III	30- < 45	70- < 118
IV	45- < 60	118- < 171
V	60- < 66	171- < 214
VI	66- < 80	214- < 262

[1] Utilize the most demanding category.
Source: FAA AC 150/5300-13, Airport Design

In order to determine airfield design requirements, the critical aircraft and critical ARC should first be determined before appropriate airport design criteria can be applied. This begins with a review of aircraft currently using the airport and those expected to use the airport through the 20-year planning period.

CURRENT CRITICAL AIRCRAFT

The critical design aircraft is defined as the most demanding category of aircraft which conduct 500 or more itinerant operations at the airport each year. In some cases, more than one specific make and model of aircraft comprises the airport's critical design aircraft. One category of aircraft may be the most critical in terms of approach speed, while another is most critical in terms of wingspan and/or tail height, which affects runway/taxiway width and separation design standards. The critical aircraft for a general aviation airport may be a specific aircraft model or it can be a combination of several aircraft within the same ARC (family of aircraft), that when combined, exceed the 500 operations threshold.

General aviation aircraft using the airport include a variety of single and multi-engine piston-powered aircraft, turboprops, business jets, and helicopters. While the airport is used by helicopters, they are not included in this determination as they are not assigned an ARC.

Based Aircraft

The determination of the critical aircraft (or family of aircraft) will first examine the types of based aircraft followed by an analysis of itinerant activity. The majority of the based aircraft are single and multi-engine piston-powered aircraft which fall within approach categories A and B and ADG I. These smaller aircraft are often used for local operations which are not included in the critical aircraft determination.

The next step is to identify the larger based aircraft including turboprops and business jets. These aircraft types typically have higher utilization rates than smaller aircraft and rarely perform local operations. These aircraft types can represent the critical aircraft on their own, due to high utilization, or in combination with other aircraft in the same ARC.

There are three based turboprop aircraft. The Piper Cheyenne (PA-31T) and a Cessna Conquest 425 are ARC B-I aircraft. The Beech King Air 300 is an ARC B-II aircraft. The based business jet is a Cessna Citation I (CJ1) 525 which falls in ARC B-I. The based CASA jet falls in ARC C-I.

Itinerant Aircraft

Accounting for activity by itinerant aircraft at non-towered general aviation airports can be challenging. Recent innovations from the FAA have made this task more manageable. The FAA has recently made available the *Enhanced Traffic Management System Counts* (ETMSC) which is an FAA database of aircraft operations. Information is added to the ETMSC database when pilots file flight plans and/or when flights are detected by the National Airspace System, usually via radar. It includes documentation of commercial traffic (air carrier and air taxi), general aviation, and military aircraft. Due to factors such as incomplete flight plans and limited radar coverage, ETMSC data cannot account for all aircraft activity at an airport. Therefore, it is likely that there are more operations at an airport than are captured by this methodology. Nonetheless, this information provides a reasonable estimate of itinerant operations.

Since business jets are larger and faster, they will typically have a greater impact on airport design standards than smaller aircraft. The following analysis will focus on itinerant activity by jets at Corvallis Municipal Airport. The FAA ETMSC database is the primary source for business jet activity at the airport. A secondary source, www.airportiq.com, was also consulted.

The website airportiq.com is an online subscription service that tracks flight plans opened and closed on the ground. While this source showed fewer jet operations than the ETMSC, valuable information such as aircraft owner, aircraft type, N-number, origin, destination, date, and time-of-day are provided. **Table 3B** presents a sampling of the business jet types that are known to operate at the airport. As can be seen, a wide variety of businesses, including the largest fractional share operators, utilize the airport. Aircraft as large as the Gulfstream V (D-III) were identified in the database. More common business jet activity is seen from those in ARC C-II and below.

TABLE 3B
Business Jet Activity by Type
Corvallis Municipal Airport

Owner/Operator	Aircraft Model	Aircraft ARC
Cascade Honey B, LLC	Cessna 525	B-I
Fugate J Larry DBA	Challenger 600	C-II
GC Air, LLC	Gulfstream V, Citation X	D-III, C-II
Kiewit Engineering Co.	Lear 45	D-I
Transmeridian Aviation, LLC	Gulfstream IV	D-II
Videx, Inc	Lear 45	D-I
Air Wolf, LLC	Lear 45	D-I
BGST, LLC	Cessna 680	B-II
Crown Air, LLC	IAI Westwind	C-I
Ingram Industries, Inc.	Cessna 680	C-II
JFWF, LLC	Hawker 800	C-I
Johnson & Johnson Finance	Hawker 800XP	C-II
Air Blessing, LLC	Hawker 800XP	C-II
Pepsi America Vending	Challenger 600	C-II
Risk Strategies, LLC	Lear 60	D-I
Swiflite Aircraft Corp.	Gulfstream IV	D-II
Citation Shares	Various	B-II, C-I, C-II
Executive Jet	Various	B-II, C-I, C-II
Flight Options	Various	B-II, C-I, C-II
Bombardier Business Jets	Various	C-I, C-II

Source: www.airportiq.com

Exhibit 3B presents the ETMSC jet activity at Corvallis Municipal Airport from 2001 through September 2011. As can be seen, most types and sizes of business jets can and do operate at the airport. From 2001 through 2010, the airport has averaged 421 annual business jet operations. The range of operations has been fairly narrow with a low of 234 operations in 2001 and a high of 674 operations in 2008.

The exhibit also shows the breakout of these business jets by approach category and airplane design group. Over the sample period, 56 percent of the business jet activity was by aircraft in approach category B, 21 percent in approach category C, and 23 percent in approach category D. In 2008, there were 352 documented operations by aircraft in approach categories C and D.

The number of business jet operations presented does not represent all jet operations at the airport. Some flight plans are not credited to the airport because they are opened or closed in the air or because radar coverage is lost. Radar coverage around the airport is typically unavailable below 1,200 feet above ground level (AGL). It is reasonable to assume that some flights to and from the airport are not credited to the airport. Therefore, the level of activity by aircraft in approach categories C and D may exceed the 500 operations threshold.

In addition, the Corvallis Municipal Airport has been planned and designed to ARC C-II standards for more than a decade. **Therefore, this master plan will consider an existing ARC of C-II for the airport.**

FUTURE CRITICAL AIRCRAFT

Since 2005, total business jet activity has consistently been above 400 annual operations and at times has reached nearly 700 according to the FAA ETMSC database. A trend has emerged where medium and large business jet (approach categories C and D) activity has also increased over time. This is not unexpected as medium and large business jets are representing a greater percentage of business jet deliveries for the last 10 years.

The aviation demand forecasts indicate the potential for continued growth in business jet activity at the airport. This includes a forecast of 10 based business jets by the long term planning horizon. The type and size of the business jets using the airport regularly can impact the design standards to be applied to the airport system. Therefore, it is important to have an understanding of what type of aircraft may use the airport in the future. Factors such as population and employment growth in the airport service area, the proximity and level of service of other regional airports, and development at the airport can influence future activity.

In 2001, approximately 47 percent of business jets manufactured were in approach category B with the remaining 53 percent being larger business jets in approach categories C and D. By 2010, only 42 percent were in approach category B and 58 percent were in approach categories C and D. Thus, the trend in business jet usage is toward larger aircraft. This trend provides an indication that the airport should at least maintain ARC C-II design standards through the long term planning period.

The trend toward manufacturing of a larger percentage of medium and large business jets, those in approach categories C and D, may lead to greater utilization of these aircraft at Corvallis Municipal Airport. **Table 3C** presents a forecast estimate of future business jet operations at Corvallis Municipal Airport.

TABLE 3C
Jet Operations Forecast By Design Category
Corvallis Municipal Airport

	HISTORICAL JET OPERATIONS*				FORECAST JET OPERATIONS			
Design Categories	2001	Percent	2010	Percent	Short Term	Inter. Term	Long Term	2032 Percent
Approach Category B	142	61%	261	43%	1,337	1,404	1,140	25%
Approach Category C	52	22%	126	21%	608	936	1,824	40%
Approach Category D	40	17%	218	36%	486	780	1,596	35%
Total	**234**	**100%**	**605**	**100%**	**2,430**	**3,120**	**4,560**	**100%**
Airplane Design Group I	110	47%	382	63%	1,458	1,778	2,280	50%
Airplane Design Group II	124	53%	215	36%	923	1,248	2,006	44%
Airplane Design Group III	0	0%	8	1%	49	94	274	6%
Total	**234**	**100%**	**605**	**100%**	**2,430**	**3,120**	**4,560**	**100%**

**Enhanced Traffic Management System Counts (ETMSC) - FAA activity database.*

By the end of the short term planning period, operations by business jets in approach category D are forecast to be 482. The combination of both C and D category operations are forecast to exceed 1,000. By the intermediate planning period, operations by aircraft in approach category D are forecast to 780. By the long term planning period, operations by aircraft in approach category D are forecast to reach nearly 1,600.

Long term planning for Corvallis Municipal Airport will consider the potential for a transition from ARC C-II to ARC D-II. This transition could be gradual as more itinerant aircraft in approach category D utilize the airport or it could be sudden if one or more of these aircraft base at the airport. In order for the airport to be in a position to accommodate a potential transition in ARC, **a future critical design aircraft in ARC D-II will be considered for this planning effort.**

CRITICAL AIRCRAFT SUMMARY

At airports without an airport traffic control tower (ATCT), precise operations counts can be difficult to determine. It is even more difficult to categorize operations by ARC. The determination of the current and future critical design aircraft has relied on the ETMSC FAA database of flight activity to and from Corvallis Municipal Airport. It is known that the data relied upon represents a minimum number of operations because not all activity is captured.

Because of the potential range of additional business jet operations, the critical aircraft determination has utilized only the raw baseline data of historical information. What has been determined is that business jets are critical for airport design and they account for more than 500 annual operations on average. The trend at the airport has been for larger

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JET OPERATIONS BY AIRPORT REFERENCE CODE *(MINIMUM)*

ARC	Aircraft Type	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*
B-I	Eclipse 500	-	-	-	-	-	-	-	-	2	2	-
	Premier 390	-	8	10	-	-	-	4	6	4	6	4
	Beechjet 400/T-1/Hawker 400	4	6	2	10	8	20	16	12	22	18	14
	Cessna 500/Citation I	8	4	4	10	6	2	4	-	4	4	2
	Cessna 501/Citation I/SP	16	16	2	2	12	14	-	2	6	12	6
	Cessna Mustang 510	-	-	-	-	-	-	-	6	12	18	18
	Cessna 525 CitationJet/CJ1	14	14	14	12	172	154	156	112	70	68	62
	Embraer Phenom 100	-	-	-	-	-	-	-	-	-	2	-
	Falcon 10	-	24	32	6	2	-	-	-	4	-	2
	Mitsubishi MU-300	-	-	-	-	-	-	2	-	-	-	-
	Rockwell Saber 40/60	2	-	-	4	-	-	-	-	2	-	-
Total B-I		**44**	**72**	**64**	**44**	**200**	**190**	**182**	**138**	**126**	**130**	**108**
B-II	Cessna 525A (CJ2)	-	-	4	4	6	4	-	-	-	4	6
	Cessna 525B (CJ3)	-	-	-	-	-	-	-	2	2	2	10
	Cessna Citation Bravo 550	22	42	28	12	22	48	46	52	32	18	24
	Cessna Citation V/Ultra/Encore 560	30	32	28	42	22	38	30	46	32	34	56
	Cessna 560 XLS	2	4	8	8	4	34	22	42	16	21	28
	Cessna Citation III/VI/VII 650	26	8	4	4	2	6	4	-	6	2	6
	Cessna Citation Sovereign 680	-	-	-	-	-	6	-	4	12	24	38
	Falcon 20	4	4	2	-	-	-	4	-	-	6	6
	Falcon 50	14	16	12	12	30	26	20	30	18	14	22
	Falcon 900	-	-	-	6	-	-	2	-	-	4	4
	Falcon 2000	-	2	2	2	-	4	4	8	12	2	10
Total B-II		**98**	**108**	**88**	**90**	**86**	**166**	**132**	**184**	**130**	**131**	**210**
C-I	BAe HS 125-1/2/3/400/600	10	6	10	6	2	-	-	-	-	-	-
	BAe HS 125/700-800/Hawker 800	16	14	20	16	22	24	16	46	28	26	32
	Learjet 23/24	2	2	2	10	4	2	2	-	2	-	-
	Learjet 25/28	4	2	-	6	10	2	-	-	-	-	-
	Learjet 31 A/B	2	8	8	4	6	6	8	10	4	6	2
	Learjet 55	-	-	6	6	-	14	2	4	4	12	2
	IAI Westwind	2	14	4	4	12	4	10	4	-	6	2
Total C-I		**36**	**46**	**50**	**52**	**56**	**52**	**38**	**64**	**38**	**50**	**38**
C-II	IAI Astra 1125	2	16	4	2	6	12	4	6	4	-	2
	IAI Galaxy/Gulfstream G200	4	2	-	-	14	16	4	8	4	6	10
	Cessna Citation 750 (X)	6	4	4	18	10	20	14	22	22	56	62
	Challenger 300	-	-	-	-	2	2	2	-	-	-	2
	Challenger 600/604	4	6	8	2	12	18	4	8	4	8	6
	Lockheed 1329 Jetstar	-	-	2	-	-	-	-	-	-	-	-
	Gulfstream III/G300	-	-	2	-	2	-	4	-	4	-	-
	Hawker 800XP, 1000, 4000	-	-	2	-	-	-	2	-	-	4	2
	Falcon 900EX & F-Series	-	-	-	-	-	-	-	-	2	-	-
Total C-II		**16**	**28**	**22**	**22**	**46**	**68**	**34**	**44**	**40**	**74**	**84**
C-III	Global Express/5000	-	2	-	-	2	2	-	-	-	2	4
Total C-III		**0**	**2**	**0**	**0**	**2**	**2**	**0**	**0**	**0**	**2**	**4**
D-I	Learjet 35/36	22	16	10	20	16	12	22	46	2	14	12
	Learjet 45	-	2	4	4	2	-	6	162	146	184	168
	Learjet 60	8	2	8	2	10	14	16	8	12	4	6
Total D-I		**30**	**20**	**22**	**26**	**28**	**26**	**44**	**216**	**160**	**202**	**186**
D-II	Gulfstream G150	-	-	-	-	-	-	4	10	8	6	6
	Gulfstream II	-	-	-	-	-	-	-	-	-	-	-
	Gulfstream IV/G400	10	4	4	16	4	4	2	8	4	4	6
Total D-II		**10**	**4**	**4**	**16**	**4**	**4**	**6**	**18**	**12**	**10**	**12**
D-III	Gulfstream V/G-500/G550	-	4	6	14	4	6	4	10	4	6	4
Total D-III		**0**	**4**	**6**	**14**	**4**	**6**	**4**	**10**	**4**	**6**	**4**
Total Jet Activity		***234***	***284***	***256***	***264***	***426***	***514***	***440***	***674***	***510***	***605***	***646***

TOTAL JET OPERATIONS BY APPROACH CATEGORY AND AIRPLANE DESIGN GROUP

Approach Category	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*
B	142	180	152	134	286	356	314	322	256	261	318
C	52	76	72	74	104	122	72	108	78	126	126
D	40	28	32	56	36	36	54	244	176	218	202
Airplane Design Group											
I	110	138	136	122	284	268	264	418	324	382	332
II	124	140	114	128	136	238	172	246	182	215	306
III	0	6	6	14	6	8	4	10	4	8	8

*Actual Through Oct. 2011. Nov. and Dec. Average of previous 5 years.
Source: Enhanced Traffic Management System Counts (ETMSC) - FAA activity database.

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Exhibit 3B
BUSINESS JET ACTIVITY

business jets, those in approach categories C and D to account for a larger percentage of the overall business jet activity. Therefore, the current critical design aircraft is ARC C-II. The future critical design aircraft is planned to be represented by those business jets that fall in ARC D-II.

A final consideration is how the airport has been planned and constructed in the past. The current ALP on record with the FAA identifies a critical aircraft in ARC C-II. The runway environment has been planned to meet these design requirements in most cases. **Therefore, this master plan will utilize design standards associated with ARC C-II, the current condition, and plan for a transition to ARC D-II in the future.**

AIRFIELD CAPACITY

Airfield capacity is measured in a variety of different ways. The **hourly capacity** measures the maximum number of aircraft operations that can take place in an hour. Very rarely will any runway reach its absolute capacity, so this measuring tool is not an effective way to determine airfield needs. The airfield **annual service volume (ASV)** is an annual level of service that is used to define airfield congestion and delay as a runway nears its hourly capacity. The airfield's calculated ASV is not the point at which gridlock occurs; rather, it is the point at which operational delays become exponential. **Aircraft delay** is the total delay incurred by aircraft using the airfield during a given timeframe. FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, provides a methodology for examining the operational capacity of an airfield for planning purposes. This analysis takes into account specific factors about the airfield. These various factors are depicted in **Exhibit 3C**. The following describes the input factors as they relate to Corvallis Municipal Airport:

- **Runway Configuration** –Runway 17-35 is 5,900 feet long and 150 feet wide. Runway 9-27, the crosswind runway, is 3,545 feet long and 75 feet wide. The runways do not intersect and are offset by greater than 15 degrees. The landing threshold to Runway 27 is displaced by 199 feet.

- **Runway Use** – Runway use will be controlled by wind and/or airspace conditions. The direction of takeoffs and landings are generally determined by the speed and direction of the wind. It is generally safest for aircraft to take-off and land into the wind, avoiding a crosswind (wind that is blowing perpendicular to the travel of the aircraft) or tailwind components. The availability of instrument approaches is also considered. Runway 17-35 is the primary runway and is utilized the most. This runway also provides the only instrument approaches so in instrument flight rule (IFR) conditions it is utilized exclusively. Runway 9-27 is available in visual conditions only.

  Analysis of 10 years of wind data obtained from the on-airport weather sensor indicates that winds are predominantly from the south to north. In this condition, Runway 17 and Runway 27 are utilized 80.35 percent of the time. When winds are from north to south, Runway 17-35 and Runway 9 are utilized 13.9 percent of the time. In non-visual conditions, only Runway 17-35 is available, which occurs approximately 5.8 percent of the year. **Table 3D** presents the runway use conditions utilized in the capacity analysis.

TABLE 3D Runway Usage Based on Wind Direction Corvallis Municipal Airport	
Runway Configuration/ Wind Direction	**Runway Use Percent**
North Flow (Winds Predominantly from South to North)	
Runway 17 and 27 VFR	80.35%
South Flow (Winds Predominantly from North to South)	
Runway 17-35 and 9 VFR	13.9%
IFR and PVC Conditions	
Runway 17-35 IFR	2.30%
Runway 17 PVC	3.5%

Visual Flight Rules (VFR): >3 miles visibility and >1,000 foot cloud ceilings
Instrument Flight Rules (IFR): Visibility >1 mile <3 miles and/or clouds >500 feet < 1,000 feet
Poor Visibility Conditions (PVC): Visibility <1 mile and/or clouds <500 feet
Source: CVO All Weather Observations 2000-2010 from on-airport AWOS

- **Exit Taxiways –** Exit taxiways have a significant impact on airfield capacity since the number and location of exits directly determines the occupancy time of an aircraft on the runway. For Corvallis Municipal Airport, those taxiway exits (located between 2,000 and 4,000 feet from the runway threshold) count in the capacity determination. There are two that exist within this range when landing to Runway 35 and one exit when landing to Runway 17.

- **Weather Conditions –** The airport operates under visual flight rules (VFR) 94.22 percent of the time. When cloud ceilings are between 500 and 1,000 feet and visibility is between one and three miles, IFR conditions apply, which is approximately 2.3 percent of the year. Poor visibility conditions (PVC) apply when cloud ceilings are below 500 feet and visibility is below one mile. PVC conditions occur 3.48 percent of the year. **Table 3E** summarizes the weather conditions between 2000 and 2010.

TABLE 3E
Annual Weather Conditions
Corvallis Municipal Airport

Condition	Cloud Ceiling	Visibility	Observations	Percent
Visual (VFR)	>1,000'	> 3 mi.	66,545	94.22%
Instrument (IFR)	≤ 1,000' and > 500'	≤ 3 mi. and Vis. > 1 mi.	1,626	2.30%
Poor Visibility (PVC)	≤ 500'	≤ 1 mi.	2,457	3.48%
		TOTAL	**70,628**	**100.00%**

Source: Data from the on-airport AWOS from 2001-2010

- **Aircraft Mix –** Aircraft mix for the capacity analysis is defined in terms of four aircraft classes. Classes A and B consist of small and medium-sized propeller and some jet aircraft, all weighing 12,500 pounds or less. These

11MP12-3C-12/07/11

Exhibit 3C
AIRFIELD CAPACITY FACTORS

aircraft are associated primarily with general aviation activity, but do include some air taxi, air cargo, and commuter aircraft. Class C consists of aircraft weighing between 12,500 pounds and 300,000 pounds, which include most business jets and some turboprop aircraft. Class D aircraft consists of large aircraft weighing more than 300,000 pounds. The airport does not experience operations by Class D aircraft; however, Class C operations are estimated to be 2.9 percent of total annual operations. This is forecast to grow to 5.7 percent by the long term planning period. The remaining are operations by Class A and Class B aircraft.

- **Percent Arrivals** – Percent arrivals generally follow the typical 50/50 percent split.

- **Touch-and-Go Activity** – Approximately 45 percent of general aviation operations are considered touch-and-go in nature. This figure will likely remain relatively constant over the planning period.

- **Peak Period Operations** – For the airfield capacity analysis, average daily operations and average peak hour operations during the peak month, as calculated in the previous chapter, are utilized. Typical operations activity is important in the calculation of an airport's annual service volume as "peak demand" levels occur sporadically. The peak periods used in the capacity analysis are representative of normal operational activity and can be exceeded at various times throughout the year.

Given the factors outlined above, the airfield ASV is estimated at 194,000. The ASV does not indicate a point of absolute gridlock for the airfield; however, it does represent the point at which operational delay for each aircraft operation will increase exponentially. The current operation level estimated for Corvallis Municipal Airport represents 28.91 percent of the airfield's ASV. By the end of the planning period, total annual operations are expected to represent 37.28 percent of the airfield's ASV. **Table 3F** summarizes the capacity analysis for Corvallis Municipal Airport.

TABLE 3F
Airfield Demand/Capacity Summary
Corvallis Municipal Airport

	PLANNING HORIZON			
	Current	Short Term	Intermediate Term	Long Term
Operational Demand				
Annual	56,079	60,100	63,400	71,200
Design Hour	39	42	44	50
Capacity				
Annual Service Volume	194,000	194,000	192,000	191,000
Percent Capacity	28.91%	30.98%	33.02%	37.28%
Weighted Hourly Capacity	136	136	135	134
Delay				
Per Operation (Seconds)	12.00	15.00	18.00	24.00
Total Annual (Hours)	187	250	317	475

Source: FAA AC 150/5060-5, Airport Capacity and Delay

FAA Order 5090.3B, *Field Formulation of the National Plan of Integrated Airport Systems* (NPIAS), indicates that improvements for airfield capacity purposes should begin to be considered once operations reach 60 to 75 percent of the annual service volume. This is an approximate level to begin the detailed planning of capacity improvements. At the 80 percent level, the planned improvements should be under design or construction. Based on current and projected operations developed for this study, improvements specifically designed to enhance capacity are not necessary during the 20-year scope of this master plan.

AIRFIELD REQUIREMENTS

As indicated earlier, airport facilities include both airfield and landside components. Airfield facilities include those facilities that are related to the arrival, departure, and ground movement of aircraft. These components include:

- Runway Configuration
- Safety Area Design Standards
- Runways
- Taxiways
- Navigational Approach Aids
- Lighting, Marking, and Signage

RUNWAY CONFIGURATION

The airport is served by two intersecting runways. Primary Runway 17-35 is 5,900 feet long and is orientated in a north to south manner. Runway 9-27 is the crosswind runway measuring 3,545 feet in length and is roughly oriented in an east to west manner. The two runways do not intersect but the Runway 9 runway safety area behind the landing threshold crosses the primary runway approximately 500 feet from the Runway 17 threshold.

For the operational safety and efficiency of an airport, it is desirable for the primary runway to be oriented as closely as possible to the direction of the prevailing wind. This reduces the impact of wind components perpendicular to the direction of travel of an aircraft that is landing or taking off.

FAA Advisory Circular 150/5300-13, *Airport Design,* recommends that a crosswind runway be made available when the primary runway orientation provides for less than 95 percent wind coverage for specific crosswind components. The 95 percent wind coverage is computed on the basis of the crosswind component not exceeding 10.5 knots (12 mph) for ARCs A-I and B-I, 13 knots (15 mph) for ARCs A-II and B-II, and 16 knots (18 mph) for ARC C-I through D-II.

Weather data specific to the airport was obtained from the National Oceanic Atmospheric Administration (NOAA) National Climatic Data Center. This data was collected from the on-field automated weather observation system (AWOS) over a continuous 10-year period from 2000 to 2010. A total of 70,628 observations of wind direction and other data points were made.

Runway 17-35 provides 94.27 percent wind coverage for 10.5 knot crosswinds, 97.28 percent coverage at 13 knots, and 99.67 percent at 16 knots. Runway 9-27 provides for 93.96 percent wind coverage at 10.5 knots, 96.94 percent at 13 knots, and 99.54 percent at 16 knots. The combined wind coverage at 10.5 knots is 99.74 percent. **Exhibit 3D** presents a wind rose of the data developed following FAA guidance.

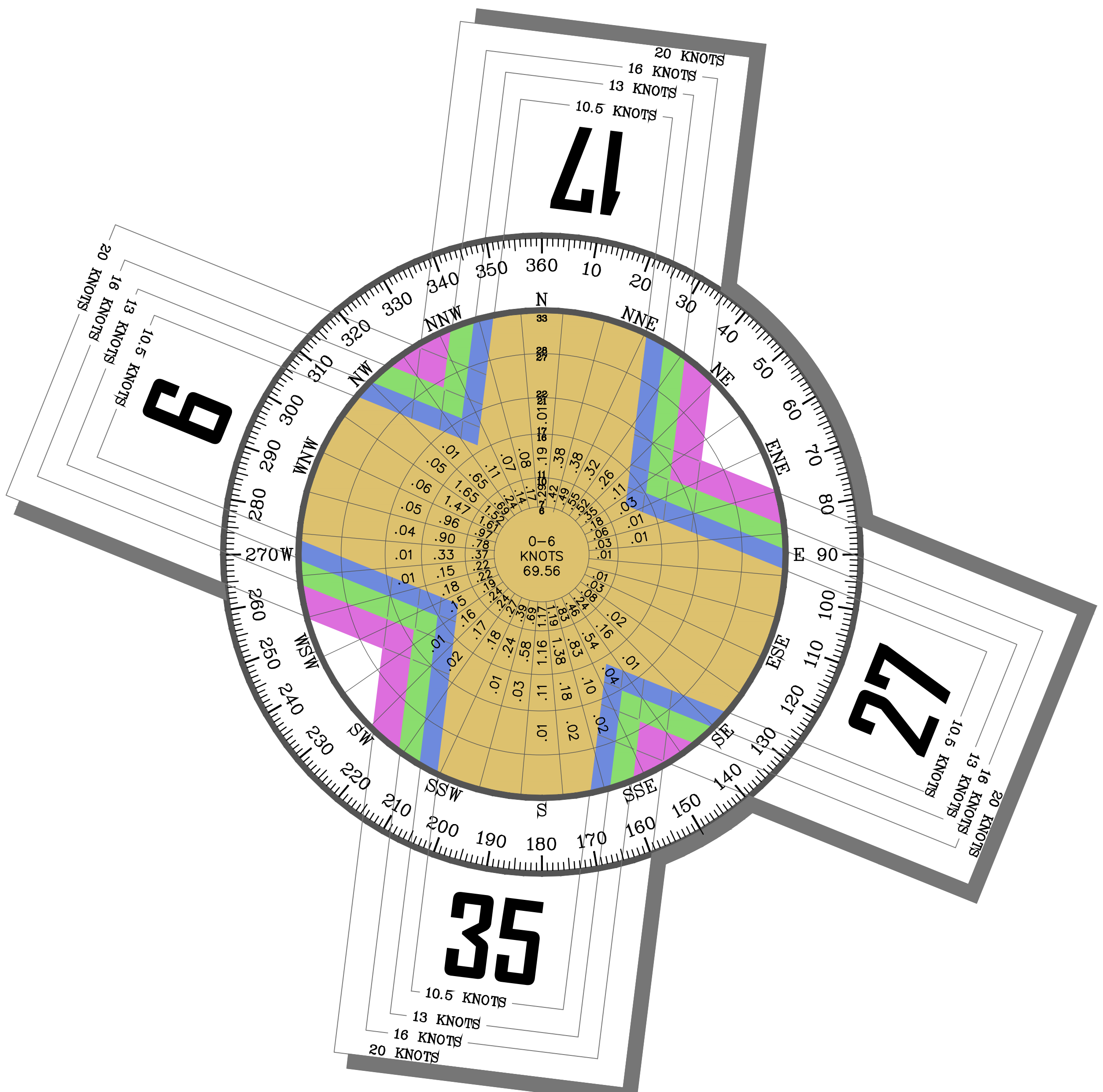
The airport should maintain the two-runway system. Runway 17-35 provides the greatest length, which is necessary when considering the current usage of the airport by larger aircraft needing more runway length. Runway 17-35 also provides instrument approach capability at the airport (other than the circling VOR-A approach). A crosswind runway is necessary to provide the required combined

ALL WEATHER WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 17–35	*94.27%*	*97.28%*	*99.67%*	*99.96%*
Runway 9–27	*93.96%*	*96.94%*	*99.54%*	*99.95%*
Combined	*99.74%*	*99.98%*	*100.00%*	*100.00%*

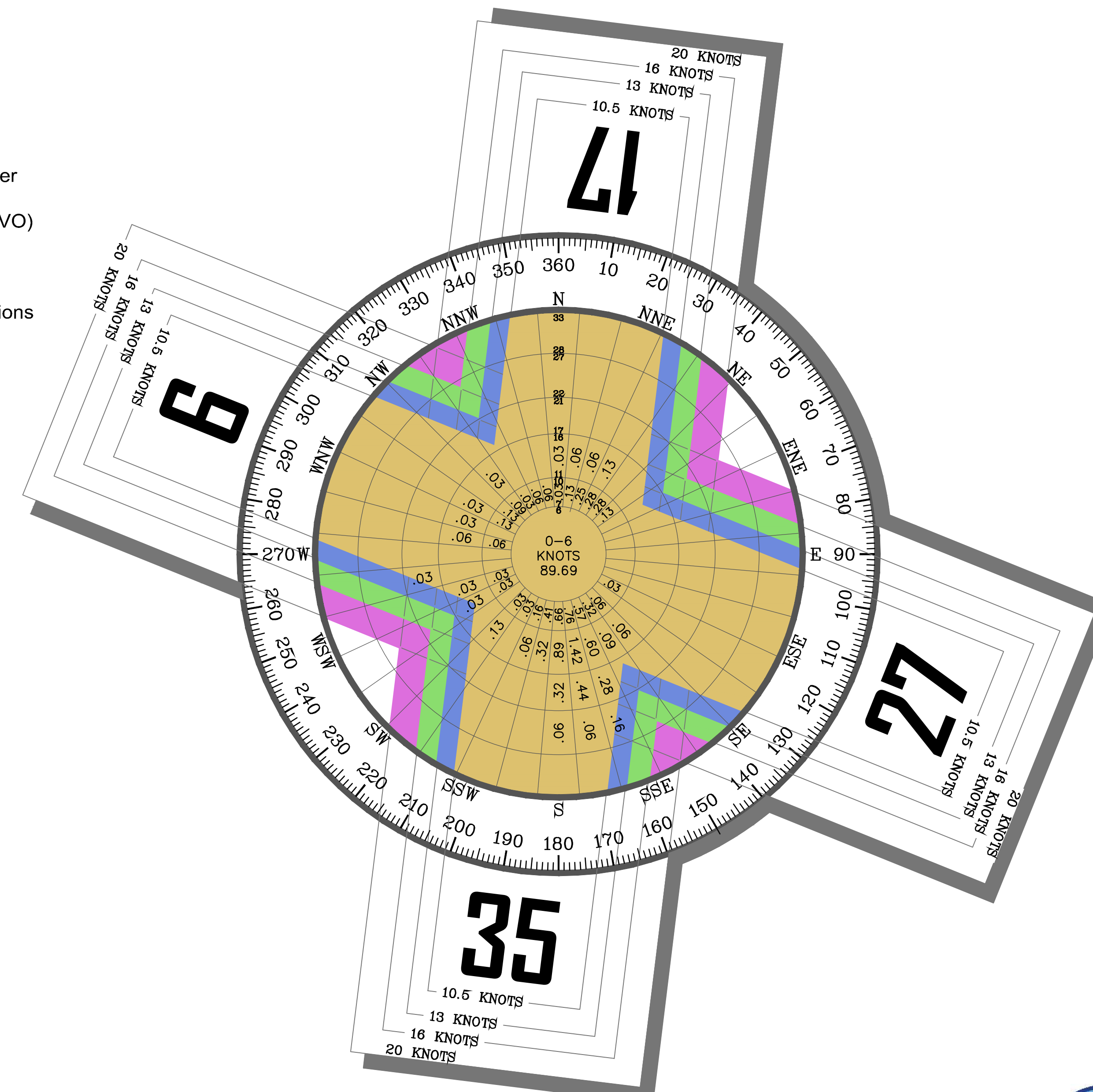
IFR WIND COVERAGE

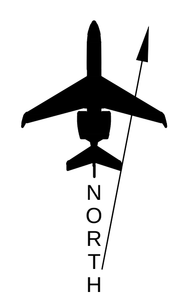
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 17–35	*98.29%*	*99.48%*	*98.56%*	*98.59%*
Runway 9–27	*95.86%*	*97.57%*	*99.17%*	*99.87%*
Combined	*99.87%*	*99.98%*	*100.00%*	*100.00%*



SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Corvallis Municipal Airport (CVO)
Corvallis, Oregon

OBSERVATIONS:
49,125 All Weather Observations
3161 IFR Observations
2001-2010





Magnetic Declination
15° 56' East (December 2011)
Annual Rate of Change
00° 08' West (December 2011)

CORVALLIS
ENHANCING COMMUNITY LIVABILITY

Exhibit 3D
WINDROSE

wind coverage that exceeds 95 percent. At a minimum, the crosswind runway should meet the design standards for aircraft in ARC B-I. Runway 9-27 is currently designed to ARC B-II standards. This allows for a greater percentage of aircraft to utilize the runway when conditions dictate.

SAFETY AREA DESIGN STANDARDS

The FAA has established several imaginary surfaces to protect aircraft operational areas and keep them free from obstructions that could affect their safe operation. These include the runway safety area (RSA), object free area (OFA), obstacle free zone (OFZ), and runway protection zone (RPZ).

The entire RSA, OFA, and OFZ must be under the direct ownership of the airport sponsor to ensure these areas remain free of obstacles and can be readily accessed by maintenance and emergency personnel. The RPZ should also be under airport ownership. An alternative to outright ownership of the RPZ is the purchase of avigation easements (acquiring control of designated airspace within the RPZ) or having sufficient land use control measures in places which ensure the RPZ remains free of incompatible development. The various airport safety areas are presented on **Exhibit 3E**.

Dimensional standards for the various safety areas associated with the runways are a function of the type of aircraft (ARC) expected to use the runways as well as the instrument approach capability. Runway 17 provides an instrument approach with ½-mile visibility minimums and 200-foot cloud ceiling heights. Runway 35 provides for ¾-mile visibility minimums and 200-foot cloud ceiling heights. There are no straight-in instrument approaches for Runway 9-27. **Table 3G** presents the FAA design standards as they apply to the runways at Corvallis Municipal Airport.

TABLE 3G
Runway Design Standards
Corvallis Municipal Airport

	Runway 17-35	**Runway 9-27**
Design Standard	**C/D-II**	**B-II**
Applicable Approach	**½ Mile**	**1 Mile/Visual**
Runway Width	100*	75
Runway Shoulder Width	10	10
Runway Safety Area		
Width	500	150
Length Beyond End	1,000	300
Length Prior to Landing	600	300
Runway Object Free Area		
Width	800	500
Length Beyond End	1,000	300
Runway Obstacle Free Zone		
Width	400	400
Length Beyond End	200	200
Runway Centerline to:		
Holding Position	250	200
Parallel Taxiway	400	240
Aircraft Parking Area	500	250

* Runway 17-35 is currently 150 feet wide.
Note: All dimensions in feet
Source: FAA AC 150/5300-13, Airport Design

Runway Safety Area (RSA)

The RSA is defined in FAA Advisory Circular (AC) 150/5300-13, *Airport Design,* as a "surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of undershoot, overshoot, or excursion from the runway." The RSA is centered on the runway and dimensioned in accordance to the approach speed of the critical aircraft using the runway. The FAA requires the RSA to be cleared and graded, drained by grading or storm sewers, capable of accommodating the design aircraft and fire and rescue vehicles, and free of obstacles not fixed by navigational purpose such as runway edge lights or approach lights.

The FAA has placed a higher significance on maintaining adequate RSA at all airports. Under Order 5200.8, effective October 1, 1999, the FAA established the *Runway Safety Area Program.* The Order states, "The objective of the Runway Safety Area Program is that all RSAs at federally-obligated airports…shall conform to the standards contained in Advisory Circular 150/5300-13, *Airport Design*, to the extent practicable." Each Regional Airports Division of the FAA is obligated to collect and maintain data on the RSA for each runway at the airport and perform airport inspections.

The RSA for Runway 17-35 should be 500 feet wide and extend 1,000 feet beyond the runway ends. The RSA for Runway 9-27 is 150 feet wide and extends 300 feet beyond the runway ends. Both runways meet RSA standard.

Object Free Area (OFA)

The runway OFA is "a two-dimensional ground area, surrounding runways, taxiways, and taxilanes, which is clear of objects except for objects whose location is fixed by function (i.e., airfield lighting)." The OFA does not have to be graded and level like the RSA; instead, the primary requirement for the OFA is that no object in the OFA penetrates the lateral elevation of the RSA. The runway OFA is centered on the runway, extending out in accordance to the critical aircraft design category utilizing the runway.

For Runway 17-35, the OFA is 800 feet wide and extends 1,000 feet beyond the end of the runway. Therefore, the OFA ends at the same distance as the RSA. For Runway 9-27, the OFA is 500 feet wide and extends 300 feet beyond the ends of the runway. Both runways meet the OFA design standard.

Obstacle Free Zone (OFZ)

The OFZ is an imaginary volume of airspace which precludes object penetrations, including taxiing and parked aircraft. The only allowance for OFZ obstructions is navigational aids mounted on frangible bases which are fixed in their location by function, such as airfield signs. The OFZ is established to ensure the safety of aircraft operations. If the OFZ is obstructed, the airport's approaches could be removed or approach minimums could be increased.

For both runways, the OFZ is 400 feet wide, centered on the runway, and extends 200 feet beyond the runway pavement ends. The OFZ for both runway ends is unobstructed.

A precision obstacle free zone (POFZ) is further defined for runway ends with a precision approach, such as the ILS approach to Runway 17. The POFZ is 800 feet wide and extends from the runway

Exhibit 3E
AIRPORT SAFETY AREAS

threshold to a distance of 200 feet. The POFZ is in effect when the following conditions are met:

a) The runway supports a vertically guided approach.
b) The reported ceiling is below 250 feet and/or visibility is less than ¾-mile.
c) An aircraft is on final approach within two miles of the runway threshold.

When the POFZ is in effect, a wing of an aircraft holding on a taxiway may penetrate the POFZ; however, neither the fuselage nor the tail may infringe on the POFZ.

Runway Protection Zones (RPZ)

The RPZ is a trapezoidal area centered on the runway, typically beginning 200 feet beyond the runway end. The RPZ has been established by the FAA to provide an area clear of obstructions and incompatible land uses, in order to enhance the protection of people and property on the ground. The RPZ is comprised of the central portion of the RPZ and the controlled activity area. The dimensions of the RPZ vary according to the visibility minimums serving the runway and the type of aircraft (design aircraft) operating on the runway.

The central portion of the RPZ extends from the beginning to the end of the RPZ, is centered on the runway, and is the width of the OFA. Only objects necessary to aid air navigation, such as approach lights, are allowed in this portion of the RPZ. Wildlife attractants, fuel farms, places of public assembly, and residences are prohibited from the RPZs. The remaining portions of the RPZ, the controlled activity areas, have strict land use limitations. FAA AC 150/5300-13*, Airport Design*, specifically allows surface parking facilities, but they are discouraged. All other uses are prohibited.

There are portions of the RPZs associated with Runways 17, 35, and 27 that extend beyond airport property. The Runway 9 RPZ is on airport property. The airport owns easements where the RPZ for Runway 17 and 27 cross airport property. The airport owns a partial easement where the RPZ for Runway 35 crosses beyond airport property. Ultimately, the airport should acquire any RPZ area that is not on airport property, as recommended by FAA

Table 3H presents the current RPZ dimensions as applied to Corvallis Municipal Airport.

TABLE 3H
Runway Protection Zones
Corvallis Municipal Airport

	Runway 17	Runway 35	Runway 9-27
Visibility Minimum	½-mile	¾-mile	Visual/1-mile
Airport Reference Code	C/D-II	C/D-II	B-II
Inner Width	1,000	1,000	500
Outer Width	1,750	1,510	700
Length	2,500	1,700	1,000

Source: FAA AC 150/5300-13, Airport Design

Runway/Taxiway Separation

The design standards for the separation between runways and parallel taxiways are a function of the critical aircraft and the instrument approach visibility minimum. Separation is measured from centerline to centerline. The separation standard for ARC C-II with ½-mile visibility minimums is 400 feet from the runway centerline to the parallel taxiway centerline. Taxiway B is 400 feet from the Runway 17-35 centerline.

Taxiway A is located 500 feet from Runway 9-27 except for the eastern portion which tapers at an angle until it intersects with the runway threshold. The design standard is for the parallel taxiway to be at least 240 feet from the runway.

According to FAA AC 150/5300-13, *Airport Design*, Change 18, the hold line separation standard for runways in approach category D are adjusted one foot for each 100 feet above mean sea level. If, in the future, the critical aircraft transitions to an aircraft in approach category D, then the hold-lines for Runway 17-35 should be positioned at 253 feet from the runway centerline instead of the current 250 feet.

Agricultural Separation Standards

The FAA has developed separation standards between agricultural activities that occur on or adjacent to airport property and certain airport features including runways, taxiways, and aprons. **Table 3J** presents these standards. To meet standard for an ADG II runway with ½-mile visibility minimums, the crop line can be no closer than 575 feet to the runway centerline. From the runway end, the distance must be at least 1,000 feet.

TABLE 3J
Agriculture Crop Separation Standards

ARC	Distance from Runway Centerline to Crop		Distance From Runway End to Crop		Distance from Taxiway Centerline to Crop	Distance from Apron to Crop
	≥ ¾-mile	< ¾-mile	≥ ¾-mile	< ¾-mile		
Category A and B Aircraft						
Group I	200'	400'	300'	600'	45'	40'
Group II	250'	400'	400'	600'	66'	58'
Category C and D Aircraft						
Group I	530'	575'	1,000'	1,000'	45'	40'
Group II*	530'	575'	1,000'	1,000'	66'	58'
Group III	530'	575'	1,000'	1,000'	93'	81'

*Most applicable to Corvallis Municipal Airport
Source: AC 150/5300-13, Airport Design

RUNWAYS

The adequacy of the existing runway system at Corvallis Municipal Airport has been analyzed from a number of perspectives, including runway orientation, runway length, pavement strength, width, and adherence to safety area standards. From this information, requirements for runway improvements were determined for the airport.

Runway 17-35 Length

Runway 17-35 is the primary runway and is 5,900 feet in length. Runway 9-27 is the crosswind runway measuring 3,545 feet in length. The determination of runway length requirements for the airport is based on five primary factors:

- Mean maximum temperature of the hottest month

- Airport elevation
- Runway gradient
- Critical aircraft type expected to use the airport
- Stage length of the longest nonstop destination (specific to larger aircraft)

The mean maximum daily temperature of the hottest month for Corvallis Municipal Airport is 82 degrees Fahrenheit (F). The airport elevation is 250 feet above mean sea level (MSL). The runway elevation difference is five feet for Runway 17-35 and one foot for Runway 9-27. The gradient of Runway 17-35 is 0.08 percent and for Runway 9-27, the gradient is 0.03 percent. Both of these conform to FAA design standards. For aircraft in approach categories A and B, the runway longitudinal gradient cannot exceed two percent. For aircraft in approach categories C and D, the maximum allowable longitudinal runway gradient is 1.5 percent.

The first step in evaluating runway length is to determine general runway length requirements for the majority of aircraft operating at the airport. The majority of operations at Corvallis Municipal Airport consist of small aircraft weighing less than 12,500 pounds. Advisory Circular 150/5325-4B, *Runway Length Requirements for Airport Design*, provides guidance for determining runway length needs. To accommodate 95 percent of small aircraft with less than 10 passenger seats, a runway length of 3,100 feet is recommended. To accommodate 100 percent of these small aircraft, a runway length of 3,600 feet is recommended. Small aircraft with 10 or more passenger seats require a runway length of 4,100 feet.

Runway length requirements for business jets weighing less than 60,000 pounds have also been calculated. These calculations take into consideration the runway gradient and landing length requirements for contaminated runways (wet). Business jets tend to need greater runway length when landing on a wet surface because of their increased approach speeds. AC 150/5325-4B stipulates that runway length determination for business jets consider a grouping of airplanes with similar operating characteristics. The AC provides two separate "family groupings of airplanes" each based upon their representative percentage of aircraft in the national fleet. The first grouping is those business jets that make up 75 percent of the national fleet, and the second group is those making up 100 percent of the national fleet. **Table 3K** presents a partial list of common aircraft in each aircraft grouping. A third group considers business jets weighing more than 60,000 pounds. Runway length determination for these aircraft must be based on the performance characteristics of the individual aircraft.

TABLE 3K
Business Jet Categories for Runway Length Determination

75 percent of the national fleet	MTOW	75-100 percent of the national fleet	MTOW	Greater than 60,000 pounds	MTOW
Lear 35	20,350	Lear 55	21,500	Gulfstream II	65,500
Lear 45	20,500	Lear 60	23,500	Gulfstream IV	73,200
Cessna 550	14,100	Hawker 800XP	28,000	Gulfstream V	90,500
Cessna 560XL	20,000	Hawker 1000	31,000	Global Express	98,000
Cessna 650 (VII)	22,000	Cessna 650 (III/IV)	22,000		
IAI Westwind	23,500	Cessna 750 (X)	36,100		
Beechjet 400	15,800	Challenger 604	47,600		
Falcon 50	18,500	IAI Astra	23,500		

MTOW: Maximum Take Off Weight
Source: FAA AC 150/5325-4B, Runway Length Requirements for Airport Design

Table 3L presents the results of the runway length analysis developed following the guidance provided in FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*. To accommodate 75 percent of the business jet fleet at 60 percent useful load, a runway length of 5,300 feet is recommended. This length is derived from a raw length of 4,627 feet that is adjusted, as recommended, for runway gradient and consideration of landing length needs on a contaminated runway (wet and slippery). Dry runways would require approximately 4,700 feet, while 5,300 feet is needed to accommodate business jets landing in wet conditions. To accommodate 100 percent of the business jet fleet at 60 percent useful load, a runway length of 5,500 feet is recommended.

TABLE 3L
Runway Length Requirements
Corvallis Municipal Airport

Airport Elevation	250 feet above mean sea level
Average High Monthly Temp.	82 degrees (August)
Runway Gradient	5' Runway17-35

Fleet Mix Category	Raw Runway Length from FAA AC	Runway Length With Gradient Adjustment (+50')	Wet Surface Landing Length for Jets (+15%)*	Final Runway Length
75% of fleet at 60% useful load	4,627'	4,677'	5,321'	5,300'
100% of fleet at 60% useful load	5,148'	5,198'	5,500'	5,500'
75% of fleet at 90% useful load	6,185'	6,235'	7,000'	7,000'
100% of fleet at 90% useful load	7,683'	7,733'	7,000'	7,800'

*Max 5,500' for 60% useful load and max 7,000' for 90% useful load
Source: FAA AC 150/5325-4B, Runway Length Requirements for Airport Design.

Utilization of the 90 percent category for runway length determination is generally not considered by the FAA unless there is a demonstrated need at the airport. This could be documented activity by a cargo carrier or by a business jet operator that flies out frequently with heavy loads. To accommodate 75 percent of the business jet fleet at 90 percent useful load, a runway length of 7,000 feet is recommended. To accommodate 100 percent of business jets at 90 percent useful load, a runway length of 7,800 feet is recommended.

The airport also realizes activity by some of the largest and heaviest (>60,000 pounds) business jets in the national fleet including the Gulfstream IV, V, and the Global Express. Determination of runway length needs for these and other business jets is derived from analysis of the flight planning manuals associated with each aircraft. **Table 3M** shows the runway length results for the individual aircraft under maximum loading conditions. As can be seen, several of the aircraft would require a runway length that exceeds the current length of 5,900 feet at maximum takeoff weight.

The current Airport Layout Plan on file with the FAA considers the possibility of extending Runway 17-35 by 1,050 feet for a total length of 6,950 feet. This additional length was planned to accommodate regular operations by commercial passenger aircraft utilized in a charter capacity. Aircraft considered include the Boeing-727, B-737, or MD-80. These types of commercial passenger aircraft are not forecast to operate regularly at the airport. Therefore, any planned extension must be justified by 500 or more annual operations by an aircraft that requires additional length.

TABLE 3M
Select Business Jet Takeoff Length Requirements
Corvallis Municipal Airport

Assumptions:
Mean Maximum Temp. of Hottest Month: 82 degrees
Runway Gradient: 5-foot runway elevation difference
Airport Elevation: 250 feet

Aircraft	75% or 100% Category of National Fleet	ARC	MTOW	Takeoff Length
Gulfstream IV	Greater Than 60,000 pounds	D-II	73,900	5,900
Gulfstream V	Greater Than 60,000 pounds	D-III	91,000	6,300
Cessna 750	100% Category	C-II	36,100	6,200
Beechjet 400	75% Category	B-I	16,100	5,800
Cessna 550	75% Category	B-II	14,100	4,600
Cessna 560	75% Category	B-II	16,830	4,000
Cessna 680	100% Category	B-II	30,300	3,900
Hawker 800XP	100% Category	C-II	26,000	5,600
Lear 45	75% Category	D-I	21,500	5,800
Lear 60	100% Category	D-I	23,500	6,500
Cessna 525	75% Category	B-I	10,700	4,000
Cessna 560XL	75% Category	B-II	20,200	3,900

ARC: Airport Reference Code
MTOW: Maximum Certified Takeoff Weight
Source: Aircraft Flight Planning Manuals

Table 3M indicates that there are several business jets that would require additional runway length under certain conditions. The Gulfstream V, for example, would require a runway length of 6,300 feet when fully loaded on hot summer days. The Lear 60 would require up to 6,500 feet under similar conditions. The Cessna Citation X, model 750, which falls in the 100 percent category of business jets, would require up to 6,200 feet of runway length.

The alternatives chapter will assess the maximum runway length that the airport site can accommodate up to 6,500 feet. Justification would come when one of these specific aircraft, or a combination of these aircraft, account for 500 annual operations.

Runway 9-27 Length

The minimum runway length that should be considered for Runway 9-27 is 3,100 feet, which would accommodate 95 percent of small aircraft. To accommodate 100 percent of small planes, a minimum runway length of 3,600 feet is recommended. To additionally accommodate small aircraft with 10 or more seats, a runway length of 4,100 feet is recommended. At 3,545 feet in length, Runway 9-27 currently provides adequate runway length for the intended operators. The existing length should be maintained through the planning period.

Runway Width

The width of the runway is a function of the ARC applied to the runway. The forecasts indicated that Runway 17-35 should currently be planned to meet design standards associated with ARC C-II with a potential future transition to ARC D-II. The minimum recommended runway width for both ARC C-II and ARC D-II is 100 feet. Runway 17-35 meets the minimum standard for width as the existing runway is 150 feet wide. In the alternatives discussion, consideration will be given to reducing the runway width to 100 feet.

Runway 9-27 is 75 feet wide which meets the design standard width for this runway. The width should be maintained.

Runway Strength

An important feature of airfield pavement is its ability to withstand repeated use by aircraft. The FAA Airport/Facility Directory places the pavement strength for Runway 17-35 at 35,000 pounds single wheel loading (S) and 73,000 pounds dual wheel loading (D) and 100,000 pounds dual tandem wheel loading (DT). These strength ratings refer to the configuration of the aircraft landing gear. For example, S indicates an aircraft with a single wheel on each landing gear. The strength rating for Runway 17-35 is adequate and should be maintained through the planning period. If the airport were to transition to ARC D-II as represented by regular usage by heavier aircraft (e.g., Gulfstream IV) then the pavement strength should be increased to 60,000 (S) and 90,000 (D).

Runway 9-27 is strength rated at 51,000 pounds S, 65,000 pounds D, and 100,000 pounds DT. The strength of this runway is adequate through the long term planning period.

TAXIWAYS

The taxiway width standard is based on the wingspan of the critical design aircraft. For a critical aircraft in ADG II, the taxiway width standard is 35 feet. The critical design aircraft currently and into the future is anticipated to remain in ADG II; therefore, taxiways should be at least 35 feet wide. All of the taxiways at Corvallis Municipal Airport are at least 35 feet wide and should be maintained at their current width. Any new taxiways should be at least 35 feet wide and consideration should be given to wider new taxiways in order to maintain consistency from one segment of the taxiway to another. **Table 3N** presents taxiway dimensional standards and the existing condition at the airport.

According to FAA AC 150/5300-13, *Airport Design*, "all entrance and crossing taxiways should intersect at a right-angle with the runway." High-speed taxiway exits are the only exception to this design standard. The AC provides further definition regarding existing and future taxiways: "All new entrance taxiways and existing taxiways designated as 'hot spots' must be perpendicular to the runway centerline. To the maximum extent possible, all existing entrance taxiways (not designated as 'hot spots') should be reconfigured to be perpendicular to the runway centerline."

Corvallis Municipal Airport does not have any designated "hot spots" but there are two existing locations where the entrance taxiways are not perpendicular to the runway. The western portion of Taxiway A serving as the threshold entrance to Runway 17 is not perpendicular to the runway. The eastern portion of Taxiway

A serving as the threshold entrance to Runway 27 is also not perpendicular to the runway. The alternatives chapter will consider options to reconfigure these taxiway entrances to their respective runways.

TABLE 3N
Taxiway Dimensions and Standards
Corvallis Municipal Airport

Design Standard	ADG II
Taxiway Width Standard	35'
Taxiway Separation Standards	
Taxiway Centerline to:	
Fixed or Movable Object	65.5'
Parallel Taxilane	105'
Taxilane Centerline to:	
Fixed or Movable Object	57.5'
Parallel Taxilane	97'
Taxiway Centerline to:	
Runway 17-35	400'
Runway 9-27	240'
Existing Taxiway Widths	
Taxiway A	40'
Taxiway B (From Twy A to Rwy 9-27)	35'
Taxiway B (From Rwy 9-27 to Rwy 35 threshold)	50'
Taxiway C (From apron to Runway 9-27)	40'
Taxiway C (From Rwy 9-27 to Rwy 17-35)	50'
Taxiways B2, B3, B4	50'
Existing Taxiway Separations	
Taxiway B to Runway 17-35	400'
Taxiway A to Runway 9-27	550'

Source: FAA AC 150/5300-13, Airport Design

INSTRUMENT NAVIGATIONAL AIDS

The airport has a sophisticated ILS (CAT-I) instrument approach to Runway 17. This approach provides for visibility minimums as low as ½-mile and cloud ceilings down to 200 feet. An LPV (Localizer Performance with Vertical Guidance) instrument approach is also available to Runway 17. This approach utilizes the constellation of GPS satellites to provide both vertical and horizontal guidance for approaching aircraft without the need for extensive ground-based equipment. The LPV approach to Runway 17 provides for visibility minimums of 1-mile and cloud ceilings of 334 feet. Runway 35 provides an LPV approach with ¾-mile visibility minimums and 200-foot cloud ceiling minimums. These are excellent instrument approaches providing all-weather capability for the airport and they should be maintained in the future.

Runway 9-27 is currently a visual runway not being served by a published instrument approach procedure. As a crosswind runway that is needed to meet FAA standard for wind coverage, if possible, an instrument approach should be made available. The alternatives chapter will also explore the possibility of implementing GPS approaches with not lower than 1-mile visibility minimums.

VISUAL NAVIGATION AIDS

The airport beacon is located just to the west of the fuel farm. The beacon provides for rapid identification of the airport with a rotating light that is green on one side and white on the opposite side. The beacon should be maintained through the planning period.

As discussed in Chapter One – Inventory, both ends of Runway 17-35 are equipped with 4-light visual approach slope indicators (VASIs). These are owned and maintained by the FAA and should be maintained for their useful life. If replacement is needed for the VASIs, consideration should be given to upgrading to precision approach path indicator (PAPIs). PAPIs are generally less expensive to maintain and provide pilots with more rapid identification of the glidepath.

Runway 27 is equipped with a PAPI-4L system. This system should be maintained through the planning period. Consideration will be given to adding a PAPI system for approaches to Runway 9.

Runway end identification lights (REIL) are strobe lights set to either side of the runway. These lights provide rapid identification of the runway end threshold. REILs should be installed at runway ends not currently providing an approach lighting system but supporting instrument operations. Runway 35 is equipped with a REIL system. A REIL system should be planned for both ends of Runway 9-27 if instrument approach procedures are implemented.

The FAA recommends an approach lighting system for instrument approaches not lower that ¾-mile and requires one for lower visibility minimums. Runway 17 has a medium intensity approach lighting system with runway alignment indicator lights (MALSR). This system is required as part of the ILS approach and allows for the visibility minimums to be ½-mile. This system should be maintained.

An approach lighting system leading to Runway 35 is recommended for instrument approaches of less than 1-mile. There is currently an LPV approach to Runway 35 with ¾-mile visibility minimums. Acceptable systems would include ODALS, MALS, SSALS, and SALS. To achieve CAT-I minimums on the Runway 35 end (½-mile visibility minimums), a more sophisticated MALSR or similar approach lighting system is required.

WEATHER AND COMMUNICATION AIDS

Corvallis Municipal Airport has one lighted windsock centrally located adjacent to Taxiway C between the two runways. The windsock provides information to pilots regarding wind conditions including direction and speed. This windsock is visible to all runway ends. There is an additional unlit supplemental windsock located to the west of the Runway 35 threshold. These windsocks should be maintained.

A segmented circle provides traffic pattern information to pilots. Corvallis Municipal Airport has a standard left hand traffic pattern for all runways. The lighted windsock is located within the segmented circle. A lighted wind tee, which provides directional information, is also located within the segmented circle. Airports without an airport traffic control tower should maintain a segmented circle.

Corvallis Municipal Airport is equipped with an Automated Weather Observing System (AWOS-3). This is an important system that automatically records weather conditions such as wind speed, wind gust, wind direction, temperature, dew point, altimeter setting, visibility, fog/haze condition, precipitation, and cloud height. This information is then transmitted at regular intervals. Aircraft in the vicinity can receive this information if they have their radio tuned to the correct frequency (135.775 MHz). In addition, pilots and individuals can call a published telephone number (541-754-0081) and receive the information via an automated voice recording. This system should be maintained through the planning period and upgraded as necessary.

Corvallis Municipal Airport is situated in the Willamette Valley, which can lead to a loss of communications with air traffic control and flight services below approximately 1,200 AGL. While not required, some airports will install a Remote Communication Outlet (RCO) or a Remote Transmitter/Receiver (RTR). These systems are aviation band radio transceivers, established to extend the communication capabilities of Flight Service Stations (FSS) and air traffic control facilities, respectively. Airport management should consider the potential to add RCO/RTR services.

A summary of the airside needs at Corvallis Municipal Airport is presented on **Exhibit 3F**.

LANDSIDE REQUIREMENTS

Landside facilities are those necessary for the handling of aircraft and passengers while on the ground. These facilities provide the essential interface between the air and ground transportation modes. The capacity of the various components of each element was examined in relation to projected demand to identify future landside facility needs. This includes components for general aviation needs such as:

- Aircraft Hangars
- Aircraft Parking Aprons
- Terminal Building Services
- Auto Parking and Access
- Airport Support Facilities

HANGARS

Utilization of hangar space varies as a function of local climate, security, and owner preferences. The trend in general aviation aircraft, whether single or multi-engine, is toward more sophisticated aircraft (and consequently, more expensive aircraft); therefore, many aircraft owners prefer enclosed hangar space to outside tie-downs.

The demand for aircraft storage hangars is dependent upon the number and type of aircraft expected to be based at the airport in the future. However, hangar development should be based upon actual demand trends and financial investment conditions.

While a majority of aircraft owners prefer enclosed aircraft storage, a number of based aircraft owners will still tie-down outside (due to the lack of hangar availability, hangar rental rates, and/or operational needs). Therefore, enclosed hangar facilities do not necessarily need to be planned for each based aircraft. At Corvallis Municipal Airport, it is estimated that 92 percent of the based aircraft are currently stored in hangars with approximately 12 aircraft regularly utilizing aircraft tie-down space on the apron. If facilities are available, it is estimated that this ratio can be maintained through the planning period.

There are three general types of aircraft storage hangars: T-hangars, executive box hangars, and conventional hangars. T-hangars are similar in size and will typically house a single engine piston-powered aircraft. Some multi-engine aircraft owners may elect to utilize these facilities as well. There are typically many T-hangar units "nested" within a single structure. There are 101 T-hangar units at the airport. For determining future aircraft storage needs, a planning standard of 1,200 square feet per based aircraft is utilized for T-hangars.

Executive box hangars are open-space facilities with no interfering supporting structure. Executive box hangars can vary in size and can either be attached to others or be stand-alone hangars. Typically, executive box hangars will house larger multi-engine, turboprop, or jet aircraft. For future planning, a standard of 2,500 square feet per aircraft is utilized for box hangars.

Conventional hangars are the familiar large hangars with open floor plans that can store several aircraft. At Corvallis Municipal Airport, the large WWII era hangar and the former Helicopter Transport Service Inc. (HTSI) hangar nearest Taxiway A are considered conventional hangars. For future planning needs, 2,500 square feet per aircraft is utilized for storage space within conventional hangars.

Table 3P presents aircraft storage needs based on the demand forecasts. Assumptions have been made on owner preferences for a storage type based on trends at general aviation airports. For example, as more individual hangars become available, it is presumed that owners currently storing their aircraft in a bulk storage conventional hangar may transition to their own hangar. It is also assumed that helicopters, jets, and turboprops will be stored in conventional or box hangars. Tie-down aircraft are assumed to be single engine piston-powered.

TABLE 3P
Hangar Needs
Corvallis Municipal Airport

	Base Year	Short Term	Intermediate Term	Long Term
Total Based Aircraft	156	167	177	200
Aircraft To Be Hangared	144	154	163	184
T-Hangars (1,200 s.f.)				
Single Engine (80%)		102	106	118
Multi-Engine (50%)		6	5	5
Turbo/Jet (0%)		0	0	0
Helicopter (0%)		0	0	0
Total T-hangar Positions	101	108	111	123
Total T-hangar Area	113,200	129,000	134,000	148,000
Total Square Feet Needed		15,800	20,800	34,800
Conventional Hangars (2,500 s.f.)				
Single Engine (10%)		13	13	15
Multi-Engine (20%)		2	2	2
Turbo/Jet (50%)		2	3	5
Helicopter (80%)		6	7	9
Total Conventional Hangar Positions	14-19	23	25	31
Total Conventional Hangar Area	31,900	56,000	64,000	78,000
Total Square Feet Needed		24,100	32,100	46,100
Box Hangars (2,500 s.f.)				
Single Engine (10%)		13	13	15
Multi-Engine (30%)		3	3	3
Turbo/Jet (50%)		2	3	5
Helicopter (20%)		1	2	2
Total Box Hangar Positions	20-29	19	21	25
Total Box Hangar Area	59,500	49,000	53,000	62,000
Total Square Feet Needed		NA	NA	2,500
Storage Hangar Needs				
Total Hangar Positions	135-149	150	158	179
Total Hangar Area (s.f.)	204,600	234,000	251,000	288,000
Total Hangar Area Need (s.f.)		29,400	46,400	83,400
Maintenance Hangars and Area	20,800	29,000	31,000	35,000
Maintenance Hangar Need (s.f.)		8,200	10,200	14,200

Source: Coffman Associates analysis

CATEGORY	AVAILABLE	SHORT TERM	LONG TERM
RUNWAYS	**Runway 17-35**	**Runway 17-35**	**Runway 17-35**
	ARC C-II	ARC C-II	ARC C/D-II
	5,900' X 150'	Maintain	Consider 6,500' x 150'
	35,000# S	Maintain	Maintain
	73,000# D	Maintain	Maintain
	100,000# DT	Maintain	Maintain
	Standard RSA, OFA, OFZ, POFZ	Maintain	Maintain
	RPZs Beyond Airport Property (Partial Easement)	Acquire (Fee Simple/Easement)	Maintain
	Precision Marking (17)	Maintain	Maintain
	Non-Precision Marking (35)	Precision Marking (with improved approach)	Maintain
	MIRL	Maintain	Maintain
	Runway 9-27	**Runway 9-27**	**Runway 9-27**
	ARC B-II	Maintain	Maintain
	3,545' x 75'	Maintain	Maintain
	51,000# S	Maintain	Maintain
	65,000# D	Maintain	Maintain
	100,000# DT	Maintain	Maintain
	Standard RSA, OFA, OFZ	Maintain	Maintain
	RPZ Beyond Airport Property (Easement)	Acquire (Fee Simple/Easement)	Maintain
	Basic Marking	Maintain	Non-Precision Marking (with improved approach)
	MIRL	Maintain	Maintain
TAXIWAYS	Centerline Marking	Maintain	Maintain
	Varying Widths All Meeting Standard	Maintain	Maintain
	Twy A Full Parallel	Right Angle Threshold Entrance	Maintain
	Twy B Full Parallel	Consider Uniform Separation from Rwy 17-35	Maintain
	MITL (Some reflectors)	Full MITL All Taxiways	Maintain
INSTRUMENT APPROACH AIDS	**Runway 17-35**	**Runway 17-35**	**Runway 17-35**
	CAT I ILS Rwy 17 (½-mile/200')	Maintain	Maintain
	LPV GPS Rwy 17 (¾-mile/334')	Consider LPV GPS Rwy 17 (½-mile/200')	Maintain
	LPV GPS Rwy 35 (¾-mile/200')	Consider LPV GPS Rwy 35 (½-mile/200')	Maintain
	Runway 9-27	**Runway 9-27**	**Runway 9-27**
	VOR-A Circling (1¼-mile/1,154')	Consider GPS Straight-in	Maintain
VISUAL APPROACH AIDS	**Runway 17-35**	**Runway 17-35**	**Runway 17-35**
	VASI-4L (17-35)	Consider PAPI 4L	Maintain
	MALSR (17)	Consider MALSR (35)	Maintain
	REIL (35)	Maintain	Maintain
	Runway 9-27	**Runway 9-27**	**Runway 9-27**
	PAPI-4L (27)	Maintain	Maintain
		Consider REILs (9-27)	Maintain
WEATHER AND NAVIGATIONAL AIDS	Beacon, AWOS, Segmented Circle, 2 Windsocks - 1 lighted, Wind Tee	Maintain Consider Upgrade to Super AWOS	Maintain

ARC - Airport Reference Code
AWOS - Automated Weather Observing System
DWL - Dual Wheel Loading
GPS - Global Positioning System
MALSR - Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
MIRL - Medium Intensity Runway Lighting
MITL - Medium Intensity Taxiway Lighting
OFA - Object Free Area
POFZ/OFZ - Precision/Obstacle Free Zone
REIL -Runway End Identification Lights
RSA - Runway Safety Area
PAPI - Precision Approach Path Indicator
S/D/DT - Single/Dual/Dual Tandem Wheel Loading
VASI - Visual Approach Slope Indicator
VOR - Very High Frequency Omni-Directional Radar

Exhibit 3F
AIRSIDE REQUIREMENTS

A portion of executive box and conventional hangars often are utilized primarily for maintenance activities or for office space. A planning standard of 175 square feet per based aircraft is considered for these purposes and is considered in addition to the aircraft storage needs. Nested T-hangar facilities typically have a small storage unit as well.

It is estimated that there is 204,600 square feet of hangar storage space available currently. This includes 113,200 square feet for T-hangars, 59,500 square feet for executive box hangars, and 31,900 square feet from conventional hangars. In the short term, there is a forecast need for an additional 15,800 square feet of T-hangar space and at least seven T-hangar positions. By the long term planning period, a total of 148,000 square feet of T-hangar space and 22 aircraft positions are forecast as needed.

Executive box hangar space appears to be adequate until the long term planning period. If a developer should choose to construct an executive box hangar, then less space would be necessary for T-hangar and conventional hangars.

There appears to be a need for additional conventional hangar space at the airport. In the short term, approximately 24,100 square feet is forecast as needed. By the long term, a total of 35,000 square feet of conventional hangar space for aircraft storage is forecast.

Dedicated maintenance and office space is also needed when new hangars are constructed. It's estimated that an additional 14,200 square feet may be needed for these purposes by the long term planning period.

It should be noted that the hangar requirements are general in nature and are based on standard hangar size estimates. If a private developer constructs a large hangar to house one plane, any extra space in that hangar may not be available for other aircraft. The actual hangar area needs will be dependent on the usage within each hangar.

AIRCRAFT PARKING APRON

The aircraft parking apron is an expanse of paved area intended for aircraft parking and circulation. Typically, a main apron is centrally located near the airside entry point, such as the terminal building or FBO facility. Ideally, the main apron is large enough to accommodate transient airport users as well as a portion of locally based aircraft. Often, smaller aprons are available adjacent to FBO hangars and at other locations around the airport. The apron layout at Corvallis Municipal Airport follows this typical pattern.

The terminal area apron encompasses approximately 34,000 square yards. Approximately 10,200 square yards of the apron is designated for transient parking. This pavement is marked with seven transient positions, each of which is large enough to accommodate business jets. The southern portion of the apron, approximately 5,600 square yards, is marked with 19 local tie-down positions. The western portion of the apron, approximately 2,000 square yards, is marked with eight local tie-down positions. The remaining 16,200 square yards is utilized for aircraft circulation, including Taxiway A that extends along the southern portion of the apron.

The apron fronting the REACH Air Medical Services office is approximately 3,000 square yards and was constructed with an

FAA grant. REACH intends to construct an adjacent hangar facing this apron.

The large WWII conventional hangar is accessible on both ends. The pavement leading to the hangar is included in the lease hold. There are seven tie-down positions on the east pavement and four tie-downs on the west pavement. In total, there are 38 local aircraft tie-down positions.

There is an 850-square-yard apron located to the east of the main apron. This apron was funded with an FAA grant and is marked with two helicopter hard stands.

FAA Advisory Circular 150/5300-13, *Airport Design*, suggests a methodology by which transient apron requirements can be determined from knowledge of busy-day operations. At Corvallis Municipal Airport, the number of itinerant spaces required is estimated at 13 percent of the busy-day itinerant operations (157 x 0.13 = 20). This results in a current need for 20 itinerant aircraft parking spaces. Of these, 16 (approximately 80 percent) should be for small aircraft and four should be for turboprops and business jets. By the long term planning period, 26 spaces are estimated to be needed, with 21 identified for small aircraft and five for larger planes.

A planning criterion of 800 square yards per aircraft was applied to determine future transient apron area requirements for single and multi-engine aircraft. For turboprops and business jets (which can be much larger), a planning criterion of 1,600 square yards per aircraft position was used. The current need for transient apron area is 19,600 square yards. By the long term planning period, approximately 24,900 square yards is estimated.

An aircraft parking apron should provide space for the number of locally based aircraft that are not stored in hangars, transient aircraft, and for maintenance activity. For local tie-down needs, an additional ten spaces are identified for maintenance activity. Maintenance activity would include the movement of aircraft into and out of hangar facilities and temporary storage of aircraft on the ramp. A planning criteria of 350 square yards is utilized for local aircraft tie-down positions. Calculations indicated that local aircraft tie-down positions are adequate through the long term planning period. Total apron parking requirements are presented in **Table 3Q**. The alternatives chapter will examine the potential for apron expansion at the airport.

TABLE 3Q
Aircraft Apron Requirements
Corvallis Municipal Airport

			FORECAST		
	Currently Available (2011)	**Calculated Need (2011)**	**Short Term**	**Intermediate Term**	**Long Term**
Local Apron Positions	27	23	23	24	26
Local Apron Area (s.y.)	7,600	8,200	8,200	8,500	9,100
Transient Apron Positions	7	20	22	23	26
Piston Transient Positions	0	16	18	18	21
Turbine Transient Positions	7	4	4	5	5
Transient Apron Area (s.y.)	10,200	19,600	21,000	22,200	24,900
Central Circulation Apron	16,200	16,200	14,600	15,350	17,000
Total Apron Area (s.y)	34,000	44,000	43,800	46,050	51,000

Note: The terminal area apron is exclusively considered in these calculations.
Source: Coffman Associates analysis

CARGO TRANSFER APRON

Corvallis Municipal Airport accommodates regular air cargo service from both FedEx and UPS. FedEx utilizes a single engine Cessna Caravan and UPS uses a small twin engine aircraft. Currently, loading and unloading of these aircraft takes place on the west side of the main terminal area apron. This area is currently marked for local tie-down positions. Operationally, air cargo delivery trucks enter the main apron and park next to the aircraft for loading and unloading.

A dedicated cargo apron would segregate air cargo aircraft and delivery trucks from other regular airport users and thereby increase safety. The airport has submitted a grant application to ConnectOregon IV for $709,000 to construct a small sort facility and 1,500-square-yard cargo apron. Should this planned apron be constructed, the size should be adequate through the intermediate planning period. In the future, additional carriers or flights may necessitate a larger apron. Therefore, long term planning should consider doubling the air cargo apron.

TERMINAL BUILDING FACILITIES

General aviation terminal facilities have several functions. Space is necessary for a pilots' lounge, flight planning, concessions, management, and storage. More advanced airports will have leasable space in the terminal building for such features as a restaurant, FBO line services, and other needs. This space is not necessarily limited to a single, separate terminal building, but can include space offered by FBOs in their hangars for these functions and services.

The methodology used in estimating general aviation terminal facility needs is based on the number of airport users expected to utilize general aviation facilities during the design hour. General aviation space requirements were then based upon providing 120 square feet per design hour itinerant passenger. Design hour itinerant passengers are determined by multiplying design hour itinerant operations by the number of passengers on the aircraft (multiplier). An increasing passenger count (from 1.9 to 2.3) is used to account for the likely increase in the number of passengers utilizing general aviation services. **Table 3R** outlines the general aviation terminal facility space requirements for Corvallis Municipal Airport.

TABLE 3R
General Aviation Terminal Area Facilities
Corvallis Municipal Airport

	Existing	Short Term	Intermediate Term	Long Term
Design Hour Operations	39	42	44	50
Design Hour Itinerant Operations	20	21	22	25
Multiplier	1.9	2.0	2.1	2.3
Total Design Hour Itinerant Passengers	37	42	47	57
General Aviation Building Space (s.f.)	1,000	5,000	5,600	6,900

Source: Coffman Associates analysis

Terminal services are provided by the airport FBO operating out of the large WWII era hangar. Approximately 1,000 square feet is dedicated for these services. In the short term, terminal building services would be adequately served with 5,000 square feet available. In the long term planning period, a total of 6,900 square feet may be necessary.

The airport terminal building is the entrance to the community for most air passengers utilizing the airport. It should be assumed that these passengers include decision-makers who may be considering investment in the community. Therefore, it is recommended that the airport sponsor be cognizant of the appearance of the airport and the terminal building in particular. Some communities will provide a separate general aviation terminal building which may include additional amenities such as a restaurant or community conference room.

SUPPORT REQUIREMENTS

Various facilities that do not logically fall within classifications of airside or landside facilities have also been identified. These other areas provide certain functions related to the overall operation of the airport.

AUTOMOBILE PARKING

Planning for adequate automobile parking is a necessary element for any airport. Parking needs can effectively be divided between transient airport users, locally based users, and airport business needs. Transient users include those employed at the airport and visitors, while locally based users primarily include those attending to their based aircraft. A planning standard of 1.9 times the design hour passenger count provides the minimum number of vehicle spaces needed for transient users. Locally based parking spaces are calculated as one-half the number of based aircraft.

A planning standard of 315 square feet per space is utilized to determine total vehicle parking area necessary, which includes area needed for circulation and handicap clearances. Parking requirements for the airport are summarized in **Table 3S**.

TABLE 3S
GA Vehicle Parking Requirements
Corvallis Municipal Airport

	Existing	Short Term	Intermediate Term	Long Term
Design Hour Itinerant Passengers	35	42	47	57
VEHICLE PARKING SPACES				
GA Itinerant Spaces	24	80	89	109
GA Based Spaces	26	84	89	100
Airport Business Parking Spaces	109	Individual Business Decision		
Total Parking Spaces	159	164	178	209
VEHICLE PARKING AREA				
GA Itinerant Parking Area (s.f.)	15,000	25,000	28,000	34,000
GA Based Parking Area (s.f.)	4,500	26,000	28,000	32,000
Airport Business Parking Area (s.f.)	50,400	Individual Business Decision		
Total Parking Area (s.f.)	69,900	51,000	56,000	66,000

Source: Coffman Associates analysis

There appears to be enough designated vehicle parking through the short term planning period. By the intermediate and long term planning periods, additional spaces may be needed. Parking should be made available in close proximity to the terminal building and airport businesses. In an effort to limit the level of vehicle traffic on the aircraft movement areas, many general aviation airports are providing separate parking in support of facilities with multiple aircraft parking positions, such as T-hangars. Vehicle parking spaces will be considered in conjunction with additional facility needs in the alternatives chapter.

AIRPORT ACCESS ROADS

Airport Place is the main airport access road. In order to access the primary parking lot for airport visitors, vehicles must pass in front of the aircraft hangar doors of the WWII era conventional hangar. While some airport visitors may understand that they are entering an active aircraft movement area, others may not. This is not an ideal access point as aircraft actively use this entrance point for the hangar. The alternatives chapter will present several options to eliminate the need for vehicles to cross an active taxilane to access the airport FBO and terminal services.

AIRCRAFT RESCUE AND FIRE-FIGHTING (ARFF) FACILITIES

Only those airports that are certificated under Title 14 Code of Federal Regulations (CFR), Part 139, are required to have on-site firefighting capabilities. Corvallis Municipal Airport is not a Part 139 airport and, therefore, is not required to have on-site firefighting capabilities. Instead, the local fire department responds to airport emergencies. Fire Station No. 4 is located approximately 3.6 miles to the north of the airport and is the designated first responder to airport emergencies.

FUEL STORAGE

The airport FBO owns the fuel storage tanks and their fuel delivery trucks. The static aboveground fuel storage capacity includes two 10,000 gallon tanks for Jet A fuel and two 10,000 gallon tanks for 100LL aviation fuel. In addition, the FBO has one truck for 100LL fuel with a 1,200 gallon capacity and two trucks, each with a capacity of 2,300 gallons for Jet A fuel.

Additional fuel storage capacity should be planned when the airport is unable to maintain an adequate supply and reserve. While each airport (or FBO) determines their own desired reserve, a 14-day reserve is common for general aviation airports. When additional capacity is needed, it should be planned in 10,000- to 12,000-gallon increments. Common fuel tanker trucks have an 8,000-gallon capacity.

Table 3T presents the forecast of fuel demand through the planning period. Jet A fuel needs were forecast based on an average of 40 gallons purchased per air taxi operations. An additional 10 gallons per itinerant general aviation operations was assumed. For 100LL aviation fuel, five gallons per local operation was assumed.

While the current capacity appears to be adequate to meet the operational needs of the airport, future operational activity levels could necessitate additional capacity needs. The airport FBO would base a decision to add fuel storage capacity on a business need.

TABLE 3T
Fuel Storage Requirements
Corvallis Municipal Airport

			Planning Horizon		
	Current Capacity	Baseline Consumption*	Short Term	Intermediate Term	Long Term
Jet A Requirements	24,600				
Annual Usage (gal.)		116,000	393,580	417,760	473,190
Daily Usage (gal.)		318	1,078	1,145	1,296
14-Day Storage (gal.)		4,449	15,096	16,024	18,150
Avgas Requirements	21,200				
Annual Usage (gal.)		60,000	138,000	144,750	160,750
Daily Usage (gal.)		164	378	397	440
14-Day Storage (gal.)		2,301	5,293	5,552	6,166

Assumptions:
Jet A: 40 gallons per air taxi operation.
10 gallons per itinerant general aviation operation.
Avgas: 5 gallons per general aviation local operation.

*Average of 2010/2011; does not include Corvallis Aero or HTSI fuel consumption.
Source: FBO fuel sales; Coffman Associates analysis

PERIMETER FENCING

As discussed in Chapter One – Inventory, the airport has security fencing surrounding the terminal area and extending along the north and east boundaries. The west and south areas of airport property do not have fencing. When feasible, the airport should complete the security fencing perimeter, a length of approximately 16,000 linear feet. This fencing also serves as a wildlife barrier that can limit the incursion of animals on the runway environment.

A summary of landside and support needs is presented on **Exhibit 3G**.

SECURITY RECOMMENDATIONS

In cooperation with representatives of the general aviation community, the Transportation Security Administration (TSA) published security guidelines for general aviation airports. These guidelines are contained in the publication entitled, *Security Guidelines for General Aviation Airports*, published in May 2004. Within this publication, the TSA recognized that general aviation is not a specific threat to national security. However, the TSA does believe that general aviation may be vulnerable to misuse by terrorists as security is enhanced in the commercial portions of aviation and at other transportation links.

To assist in defining which security methods are most appropriate for a general aviation airport, the TSA defined a series of airport characteristics that potentially affect an airport's security posture. These include:

1. Airport Location – An airport's proximity to areas with over 100,000 residents or sensitive sites that can affect its security posture. Greater security emphasis should be given to airports within 30 miles of mass population centers (areas with over 100,000 residents) or sensitive areas such as military installations, nuclear and chemical plants, centers of government, national monuments, and/or international ports.

11MP12-3G-11/03/11

	Base Year (2011)	Short Term	Intermediate Term	Long Term
Aircraft				
Based Aircraft	156	167	177	200
Aircraft to be tied down	12	13	14	16
Aircraft to be Hangared				
Single Engine	123	128	133	147
Multi-Engine	11	11	10	9
Turboprop	3	4	5	7
Jet	2	4	6	10
Helicopter	5	7	9	11
Total to be Hangared	**144**	**154**	**163**	**184**
Hangar Positions				
T-Hangars Positions	101	108	111	123
Box Hangar Positions	20-29	19	21	25
Conventional Hangar Positions	14-19	23	25	31
Hangar Area				
T-Hangars (s.f.)	113,200	129,000	134,000	148,000
Executive Box Hangar (s.f.)	59,500	49,000	53,000	62,000
Conventional Hangar (s.f.)	31,900	56,000	64,000	78,000
Maintenance Area (s.f.)	20,800	29,000	31,000	35,000
Aircraft Parking				
Local Apron Positions	27	23	24	26
Local Apron Area (s.y.)	7,600	8,200	8,500	9,100
Transient Apron Positions	7	22	23	26
Piston Transient Positions	0	18	18	21
Turbine Transient Positions	7	4	4	4
Transient Apron Area (s.y.)	10,200	21,000	22,200	24,900
Circulation Apron	16,200	14,600	15,350	17,000
Total Apron Area (s.y)	**34,000**	**43,800**	**46,050**	**51,000**
Cargo Apron				
Positions	NA	1	1	2
Area (s.y.)	NA	1,500	1,500	3,000
Auto Parking				
Total Spaces	159	163	177	209
Total Area (s.f.)	69,900	51,000	56,000	66,000
Terminal Building				
Area (s.f.)	1,000	5,000	5,600	6,900

Red indicates area of need.

Exhibit 3G
LANDSIDE REQUIREMENTS

2. Based Aircraft – A smaller number of based aircraft increases the likelihood that illegal activities will be identified more quickly. Airports with based aircraft weighing more than 12,500 pounds warrant greater security measures.

3. Runways – Airports with longer paved runways are able to serve larger aircraft. Shorter runways are less attractive as they cannot accommodate the larger aircraft which have more potential for damage.

4. Operations – The number and type of operations should be considered in the security assessment.

Table 3U summarizes the recommended airport characteristics and ranking criterion. The TSA suggests that an airport rank its security posture according to this scale to determine the types of security enhancements that may be appropriate. As shown in the table, the Corvallis Municipal Airport ranking on this scale is 30. Points are assessed for the airport having more than 101 based aircraft, having a runway greater than 5,001 feet in length, having a paved runway surface, having 14 CFR Part 135 charter operations, and for having flight training and rental aircraft activities at the airport. In addition, the airport having more than 50,000 annual operations, and major airframe maintenance and repair capabilities, enhance the need for adequate security.

TABLE 3U
General Aviation Airport Security Measurement Tool
Transportation Security Administration

	Assessment Scale	
Security Characteristic	**Public Use Airport**	**Corvallis Municipal Airport**
Location		
Within 20nm of mass population areas[1]	5	0
Within 30nm of a sensitive site[2]	4	0
Falls within outer perimeter of Class B airspace	3	0
Falls within boundaries of restricted airspace	3	0
Based Aircraft		
Greater than 101 based aircraft	3	3
26-100 based aircraft	2	0
11-25 based aircraft	1	0
10 or fewer based aircraft	0	0
Based aircraft over 12,500 pounds	3	0
Runways		
Runway length greater than 5,001 feet	5	5
Runways less than 5,000 feet and greater than 2,001 feet	4	0
Runway length less than 2,000 feet	2	0
Asphalt or concrete runway	1	1
Operations		
Over 50,000 annual operations	4	4
Part 135 operations (Air taxi and fractionals)	3	3
Part 137 operations (Agricultural aircraft)	3	3
Part 125 operations (20 or more passenger seats)	3	0
Flight training	3	3
Flight training in aircraft over 12,500 pounds	4	0
Rental aircraft	4	4
Maintenance, repair, and overhaul facilities conducting long-term storage of aircraft over 12,500 pounds	4	4
Totals	**64**	**30**

[1] An area with a population over 100,000
[2] Sensitive sites include military installations, nuclear and chemical plants, centers of government, national monuments, and/or international ports

Source: Security Guidelines for General Aviation Airports (TSA 2004)

As shown in **Table 3V**, a rating of 30 points places Corvallis Municipal Airport on the third tier ranking of security measures by the TSA. This rating clearly illustrates the importance of meeting security needs at Corvallis Municipal Airport as the activity at the airport grows. The airport is not projected to transition to the fourth tier during the planning period. Based upon the results of the security assessment, the TSA recommends 13 potential security enhancements for Corvallis Municipal Airport. These enhancements are outlined in **Table 3V** and are discussed in detail as follows:

TABLE 3V
Recommended Security Enhancements
Corvallis Municipal Airport

	Points Determined Through Airport Security Characteristics Assessment			
Security Enhancements	**> 45**	**25-44**	**15-24**	**0-14**
Fencing	■			
Hangars	■			
Closed-Circuit Television (CCTV)	■			
Intrusion Detection System	■			
Access Controls	■	■		
Lighting System	■	■		
Personal ID System	■	■		
Challenge Procedures	■	■		
Law Enforcement Support	■	■	■	
Security Committee	■	■	■	
Transient Pilot Sign-in/Sign-Out Procedures	■	■	■	
Signs	■	■	■	
Documented Security Procedures	■	■	■	■
Positive/Passenger/Cargo/Baggage ID	■	■	■	■
Aircraft Security	■	■	■	■
Community Watch Program	■	■	■	■
Contact List	■	■	■	■

Source: Security Guidelines for General Aviation Airports

Access Controls: To delineate and adequately protect security areas from unauthorized access, it is important to consider boundary measures such as fencing, walls, or other physical barriers, electronic boundaries (e.g., sensor lines, alarms), and/or natural barriers. Physical barriers can be used to deter and delay the access of unauthorized persons onto sensitive areas of airports. Such structures are usually permanent and are designed to be a visual and psychological deterrent as well as a physical barrier. The airport provides perimeter fencing with access control gates for both vehicles and pedestrians.

Lighting System: Protective lighting provides a means of continuing a degree of protection from theft, vandalism, or other illegal activity at night. Security lighting systems should be connected to an emergency power source, if available.

Personal ID System: This refers to a method of identifying airport employees or authorized tenants and allowing access to various areas of the airport through badges or biometric controls.

Vehicle ID System: This refers to an identification system which can assist airport personnel and law enforcement in identifying authorized vehicles. Vehicles can be identified through the use of decals, stickers, or hang tags.

Challenge Procedures: This involves an airport watch program which is implemented in cooperation with airport users and tenants to be on guard for unauthorized and potentially illegal activities at the airport.

Law Enforcement Support: This involves establishing and maintaining a liaison with appropriate law enforcement including local, state, and federal agencies. These organizations can better serve the airport when they are familiar with airport operating procedures, facilities, and normal activities. Procedures may be developed to have local law enforcement personnel regularly or randomly patrol ramps and aircraft hangar areas, with increased patrols during periods of heightened security.

Security Committee: This committee should be composed of airport tenants and users drawn from all segments of the airport community. The main goal of this group is to involve airport stakeholders in developing effective and reasonable security measures and disseminating timely security information.

Transient Pilot Sign-in/Sign-Out Procedures: This involves establishing procedures to identify non-based pilots and aircraft using their facilities, and implementing sign-in/sign-out procedures for all transient operators and associating them with their parked aircraft. Having assigned spots for transient parking areas can help to easily identify transient aircraft on an apron.

Signs: The use of signs provides a deterrent by warning of facility boundaries as well as notifying of the consequences for violation.

Documented Security Procedures: This refers to having a written security plan. This plan would include documenting the security initiatives already in place at Corvallis Municipal Airport, as well as any new enhancements. This document should consist of airport and local law enforcement contact information, and include utilization of a program to increase airport user awareness of security precautions such as an airport watch program.

Positive/Passenger/Cargo/Baggage ID: A key point to remember regarding general aviation passengers is that the persons boarding these flights are generally better known to airport personnel and aircraft operators than the typical passenger on a commercial airliner. Recreational general aviation passengers are typically friends, family, or acquaintances of the pilot in command. Charter/sightseeing passengers typically will meet with the pilot or other flight department personnel well in advance of any flights. Suspicious activities, such as use of cash for flights or probing or inappropriate questions, are more likely to be quickly noted and authorities could be alerted. For corporate operations, typically all parties onboard the aircraft are known to the pilots. Airport operators should develop methods by which individuals visiting the airport can be escorted into and out of aircraft movement and parking areas.

Aircraft Security: The main goal of this security enhancement is to prevent the intentional misuse of general aviation aircraft for criminal purposes. Proper securing of aircraft is the most basic method of enhancing general aviation airport security. Pilots should employ multiple methods of securing their aircraft to make it as difficult as possible for an unauthorized person to gain access to it. Some basic methods of securing a general aviation aircraft include: ensuring that door locks are consistently used to prevent unauthorized access or tampering with the aircraft; using keyed ignitions where appropriate; storing the aircraft in a hangar, if available, and locking hangar doors, using an auxiliary lock to further protect aircraft from unauthorized use (i.e., propeller, throttle, and/or tie-down locks); and ensuring that aircraft ignition keys are not stored inside the aircraft.

Community Watch Program: The vigilance of airport users is one of the most prevalent methods of enhancing security at general aviation airports. Typically, the user population is familiar with those individuals who have a valid purpose for being on the airport property. Consequently, new faces are quickly noticed. A watch program should include elements similar to those listed below. These recommendations are not all-inclusive. Additional measures that are specific to each airport should be added as appropriate, including:

- Coordinate the program with all appropriate stakeholders, including airport officials, pilots, businesses and/or other airport users.
- Hold periodic meetings with the airport community.
- Develop and circulate reporting procedures to all who have a regular presence on the airport.
- Encourage proactive participation in aircraft and facility security and heightened awareness measures. This should include encouraging airport and line staff to "query" unknowns on ramps, near aircraft, etc.
- Post signs promoting the program, warning that the airport is watched. Include appropriate emergency phone numbers on the sign.
- Install a bulletin board for posting security information and meeting notices.
- Provide training to all involved for recognizing suspicious activity and appropriate response tactics.

Contact List: This involves the development of a comprehensive list of responsible personnel/agencies to be contacted in the event of an emergency procedure. The list should be distributed to all appropriate individuals. Additionally, in the event of a security incident, it is essential that first responders and airport management have the capability to communicate. Where possible, coordinate radio communication and establish common frequencies and procedures to establish a radio communications network with local law enforcement.

Other security measures may be considered by the airport as the local need demands. The additional measures include full perimeter fencing, hangar availability, closed-circuit television, and intrusion detection systems.

FRACTIONAL JET OPERATOR SECURITY REQUIREMENTS

The major fractional jet operators have established minimum standards for airports serving their aircraft. These minimum standard documents specify the following general security requirements.

Identification: The airport should issue unique identification badges for employees who have access to the aircraft operations areas. Unescorted passenger access to the ramp is prohibited.

Employees: The airport must conduct FAA-compliant background checks on each employee. The airport must have pre-employment drug screening.

Aircraft Security: Aircraft cannot be left unattended when the ground power unit or auxiliary power unit is operating. Aircraft must be locked when unattended. Aircraft must be parked in well-lit, highly visible areas with a minimum of six-foot chain link fencing. Security cameras are preferred. Sightseers or visitors are not allowed access aboard or near aircraft.

Facility Security: Visual surveillance of all aircraft operational areas belonging to the airport is required. The airport shall establish controlled access to the aircraft operational areas. The airport should maintain at least six feet between safety fence and parked ground equipment. Bushes and shrubs must be less than four feet in height.

SUMMARY

The intent of this chapter has been to outline the facilities required to meet potential aviation demand projected for Corvallis Municipal Airport for the next 20 years. In an effort to provide a more flexible master plan, the yearly forecasts from Chapter Two have been converted to planning horizon levels. The short term roughly corresponds to a five-year time frame, the intermediate term is approximately 10 years, and the long term is 20 years. By utilizing planning horizons, airport management can focus on demand indicators for initiating projects and grant requests rather than on specific dates in the future.

The airport has been planned and designed to meet FAA design standards associated with ARC C-II. This category includes most small and medium size business jets such as the Cessna Citation X, Dassault Falcon 900EX, and Bombardier Challenger 604. Operational trends at the airport indicate that a larger percentage of business jet activity is by larger aircraft. As a result, a future design standard associated with ARC D-II will be considered. Aircraft contributing to this design standard would be Lear models 45 and 60, Gulfstream IVs and Vs.

At 5,900 feet in length, Runway 17-35 meets the needs of 75 percent of the national business jet fleet at 60 percent useful load. Some aircraft within the critical aircraft family may require up to 6,500 feet when operating with heavy loads in hot conditions. The alternatives chapter will examine the possibility of an ultimate runway length of 6,500 feet. Ultimately, a need by one or several business jet operators for more runway length will be necessary to justify any runway extension.

Runway 9-27, at 3,545 feet in length, meets the needs for a crosswind runway. This runway should be maintained in its current configuration.

On the landside, planning calculations show a need for additional hangars. Specifically, there is a need for T-hangars and bulk storage conventional hangar space. In the intermediate and long terms, there is an additional need for executive box hangar space. Hangar space will largely depend on individual desires and may not precisely follow the forecast.

Surface road access to the airport is an important planning consideration. Of particular concern is the current layout of Airport Place that requires airport visitors to cross in front of the hangar doors of the large main hangar. Potential intermixing of aircraft and vehicles in this manner should be avoided.

The next chapter, Alternatives, will examine potential improvements to the airfield system and the landside. Most of the alternatives discussion will focus on those capital improvements that would be eligible for federal grant funds. Other projects of local concern will also be presented. On the landside, several facility layouts that meet the forecast demands over the next 20 years will be presented. Ultimately, an overall airport layout vision that is well beyond the 20-year scope of the master plan will be developed.